



# MAX2112 Evaluation Kit

## General Description

The MAX2112 evaluation kit (EV kit) simplifies the testing and evaluation of the IC direct-conversion tuner. The evaluation kit is fully assembled and tested at the factory. Standard 50Ω SMA and BNC connectors are included on the EV kit for the inputs and outputs to allow quick and easy evaluation on the test bench.

This document provides a list of equipment required to evaluate the device, a straightforward test procedure to verify functionality, a description of the EV kit circuit, the circuit schematic, a component list for the kit, and artwork for each layer of the PCB.

## Features

- ◆ Easy Evaluation of the MAX2112
- ◆ 50Ω RF Input SMA Connector
- ◆ 50Ω Baseband Output BNC Connector
- ◆ Single 3.3V ±5% Supply
- ◆ I<sup>2</sup>C 2-Wire Serial Interface
- ◆ All Critical Peripheral Components Included
- ◆ Fully Assembled and Tested
- ◆ PC Control Software  
(available at [www.maxim-ic.com/evkitsoftware](http://www.maxim-ic.com/evkitsoftware))

## Ordering Information

PART	TYPE
MAX2112EVKIT+	EV Kit

+Denotes lead(Pb)-free and RoHS compliant.

## Component List

DESIGNATION	QTY	DESCRIPTION
ADDR	0	Not installed, 3-pin (1 x 3) inline header, 0.01in centers Sullins PEC36SAAN
BB_I_O/P, BB_Q_O/P	2	50Ω BNC PC mounts Amphenol 31-5329-52RFX
BB_IN, BB_IP, BB_QN, BB_QP, CP_OUT, J12, J13, J17, REF_O/P, VGC	10	PC mini red test points Keystone 5000
C1–C6, C9	7	1000pF ±10% ceramic capacitors (0603) Murata GRM188R71H102K
C7, C13, C19, C20, C75	5	0.1μF ±10% ceramic capacitors (0603) Murata GRM188R71C104K
C8, C12, C25–C30	0	Not installed, capacitors
C10, C11	2	0.047μF ±10% ceramic capacitors (0603) Murata GRM188R71C473K

DESIGNATION	QTY	DESCRIPTION
C14	1	100pF ±5% ceramic capacitor (0603) Murata GRM1885C1H101J
C15	1	0.033μF ±10% ceramic capacitor (0603) Murata GRM188R71E333K
C16	1	2200pF ±5% ceramic capacitor (0603) Murata GRM188R71H222J
C17, C18	2	10μF ±10% tantalum capacitors (C Case) AVX TAJC016K016
C22	1	43.2Ω ±1% resistor (0603); use lead-free parts only
C23, C24, C71, C72, C73	5	330pF ±5% ceramic capacitors (0603) Murata GRM1885C1H331J
J6	1	DB25 right-angle male connector AMP 5747238-4

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## Component List (continued)

DESIGNATION	QTY	DESCRIPTION
JP_VCC, VCC_BB, VCC_DIG, VCC_LO, VCC_RF1, VCC_RF2, VCC_SYN, VCC_VCO	0	Not installed, 2-pin (1 x 2) inline headers, 0.01in centers Sullins PEC36SAAN
L1	1	33pF $\pm 5\%$ capacitor (0603) Murata GRM1885C1H330J
R2, R12, R18, R19, R20, R22, R25, R27–R33	0	Not installed, resistors
R3, R7, R15, R16, R17, R21	6	0 $\Omega$ $\pm 5\%$ resistors (0603); use lead-free parts only
R4, R13, R24	3	1k $\Omega$ $\pm 5\%$ resistors (0603); use lead-free parts only
R5	1	820 $\Omega$ $\pm 5\%$ resistor (0603); use lead-free parts only
R6	1	390 $\Omega$ $\pm 5\%$ resistor (0603); use lead-free parts only
R8	1	86.6 $\Omega$ $\pm 1\%$ resistor (0603); use lead-free parts only
R9, R10, R11, R41, R42	5	100 $\Omega$ $\pm 1\%$ resistors (0603); use lead-free parts only
R14, R43	2	5.1k $\Omega$ $\pm 5\%$ resistors (0603); use lead-free parts only
R23, R26	2	0.1 $\mu$ F $\pm 10\%$ ceramic capacitors (0603) Murata GRM188R71C104K

DESIGNATION	QTY	DESCRIPTION
R46, R47	2	2.7k $\Omega$ $\pm 5\%$ resistors (0603); use lead-free parts only
REF_INPUT	0	Not installed, SMA edge-mount connector, round contact Emerson 142-0701-801
RF_INPUT	1	SMA edge-mount connector, round contact Emerson 142-0701-801
U1	1	Maxim DVBS tuner MAX2112ETI+ (28-pin thin QFN-EP)
U2, U4	0	Not installed, Maxim single-supply op amps with R2R outputs Maxim MAX4453ESA
U3	1	74LV07A hex buffer/driver OC TI SN74LV07ADR
U5	0	Not installed, Maxim open I/O comparator MAX985
Y1	1	27MHz crystal Citizen America 300-8571-1-ND Digi-Key HCM49-27.000MABJ-UT
—	0	Not installed, shunts (JP_VCC, VCC_BB, VCC_DIG, VCC_LO, VCC_RF1, VCC_RF2, VCC_SYN, VCC_VCO) Shorting jumpers, 2 position Sullins SSC02SYAN
—	1	PCB: MAX2112/20 EVALUATION KIT+

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## Component Suppliers

SUPPLIER	PHONE	FAX	WEBSITE
AMP/Tyco Electronics	800-522-6752	—	www.tycoelectronics.com
Amphenol RF	800-627-7100	—	www.amphenolrf.com
AVX Corp.	843-448-9411	843-448-7139	www.avxcorp.com
Digi-Key Corp.	800-344-4539	218-681-3380	www.digikey.com
Emerson Network Power	507-833-8822	—	www.emersonnetworkpower.com
Keystone Electronics Corp.	209-796-2032	—	www.keyelco.com
Maxim Integrated Products, Inc.	888-629-4642	800-992-1884	www.maxim-ic.com
Murata Mfg. Co., Ltd.	770-436-1300	770-436-3030	www.murata.com
Sullins Electronics Corp.	760-744-0125	760-744-6081	www.sullinselectronics.com
Texas instruments	800-336-5236	—	www.ti.com

**Note:** Indicate that you are using the MAX2112 when contacting these component suppliers.

## Quick Start

### Test Equipment Required

- One dual-output power supply capable of supplying up to 3.3V at > 160mA for V<sub>CC</sub> and 3V at > 50 $\mu$ A for V<sub>GC</sub> gain control voltage
- One RF signal generator capable of delivering at least 0dBm of output power at frequencies up to 2.175GHz
- One RF spectrum analyzer capable of covering the operating frequency range of the device
- One PC (486DX33 or better) with Windows® 95/98/2000/NT, Windows 4.0/XP® or later operating system, 64MB of memory, and an available parallel port
- One 25-pin parallel cable
- One multichannel digital oscilloscope (optional)
- One network analyzer to measure return loss (optional)
- One ammeter to measure supply current (optional)

### Procedure

The EV kit is fully assembled and factory tested. Follow the instructions in the *Connections and Setup* section for proper device evaluation.

### Measurement Considerations

The EV kit includes on-board matching circuitry at the MAX2112 RF input to convert the 50 $\Omega$  source to a 75 $\Omega$  input. Note that the input power to the device must be

adjusted to account for the -6dB power loss of the matching resistor network.

### Connections and Setup

This section provides a step-by-step guide to testing the basic functionality of the EV kit in UHF mode.

**Caution: Do not turn on DC power or RF signal generators until all connections are completed.**

- 1) Verify that all jumpers are in place.
- 2) With its output disabled, connect the DC power supply to V<sub>GC</sub> set to 0.5V (maximum gain).
- 3) With its output disabled, set the DC power supply to 3.3V. Connect the power supply to the V<sub>CC</sub> (through an ammeter if desired) and GND terminals on the EV kit. If available, set the current limit to 200mA.
- 4) With its output disabled, set the RF signal generator to a 955MHz frequency at -69dBm to account for the 6dB resistive pad loss. When measuring noise figure, this 6dB must also be accounted for by subtracting 6dB from the measured noise figure, unless the pad has been removed.
- 5) Connect the output of the RF signal generator to the SMA connector labeled RF\_INPUT on the evaluation board.
- 6) Connect a 25-pin parallel cable between the PC's parallel port and the EV kit board.

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- 7) Turn on the 3.3V  $V_{CC}$  power supply, followed by the 3V gain-control power supply. The supply current from the 3.3V  $V_{CC}$  supply should read approximately 100mA, and the supply current from the 3V  $V_{GC}$  should read approximately 50 $\mu$ A. Be sure to adjust the power supply to account for any voltage drop across the ammeter.
- 8) Install and run the IC control software. Software is available for download on the Maxim website at [www.maxim-ic.com/evkitsoftware](http://www.maxim-ic.com/evkitsoftware).
- 9) Load the default register settings from the control software by clicking **Edit: Load Defaults**. Set ICP = 1 and BBG[3:0] = 1011.
- 10) Connect the output to a spectrum analyzer or an oscilloscope.
- 11) Enable the RF signal generator's output.
- 12) Activate and set the power level of the RF generator to achieve 1V<sub>P-P</sub> at the baseband BNC connector outputs.
- 13) Check the I/Q outputs.
- 14) Observe the baseband output at 5MHz with 1V<sub>P-P</sub>.

### **Layout Considerations**

The EV kit can serve as a guide for PCB layout. Keep RF signal lines as short as possible to minimize losses and radiation. Use controlled impedance on all high-frequency traces. The exposed paddle must be soldered evenly to the board's ground plane for proper operation. Use abundant vias beneath the exposed paddle for maximum heat dissipation. Use abundant ground vias between RF traces to minimize undesired coupling.

To minimize coupling between different sections of the IC, the ideal power-supply layout is a star configuration, which has a large decoupling capacitor at the central  $V_{CC}$  node. The  $V_{CC}$  traces branch out from this node, with each trace going to separate  $V_{CC}$  pins of the IC. Each  $V_{CC}$  pin must have a bypass capacitor with a low impedance to ground at the frequency of interest. Do not share ground vias among multiple connections to the PCB ground plane.

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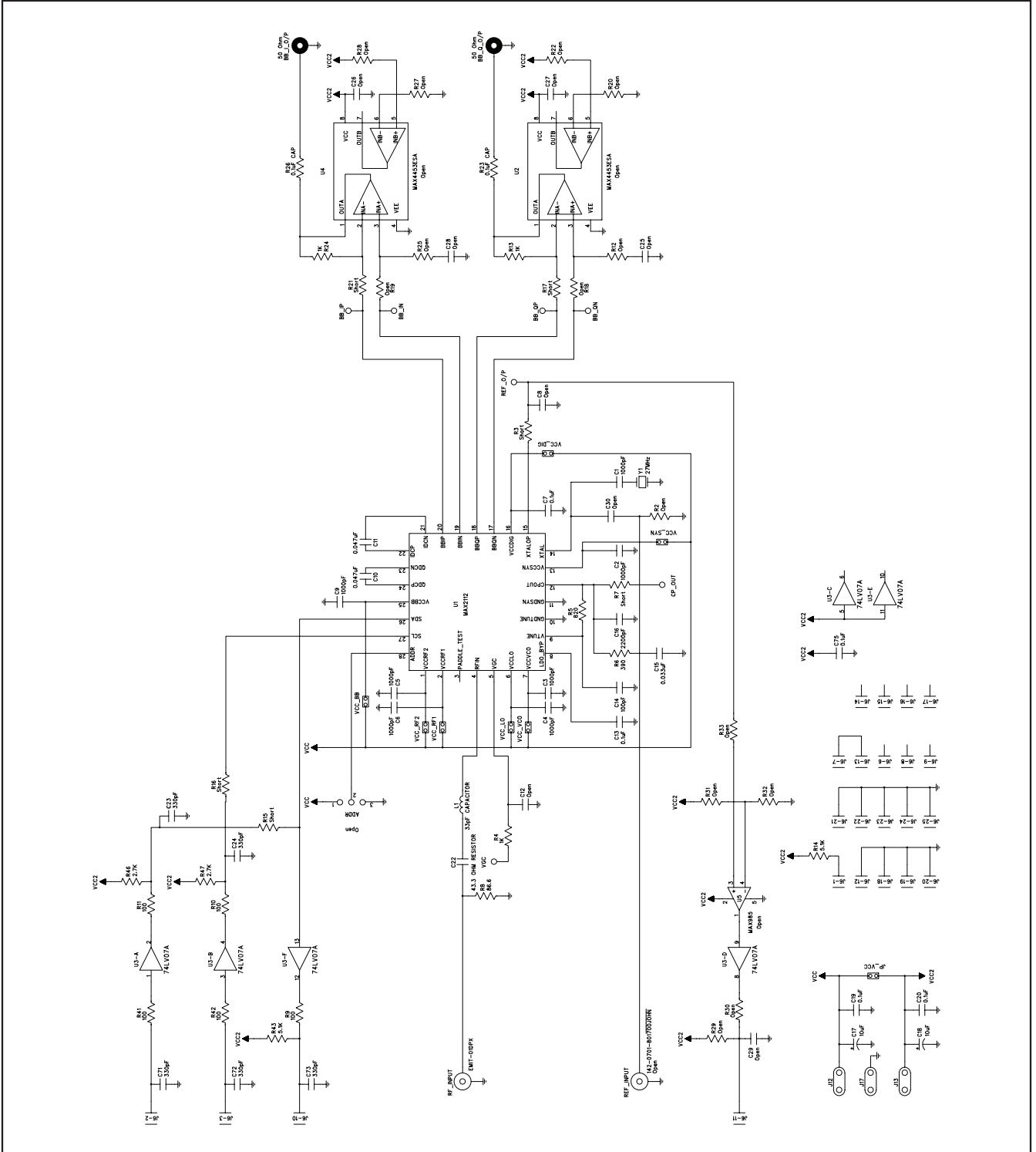


Figure 1. MAX2112 EV Kit Schematic

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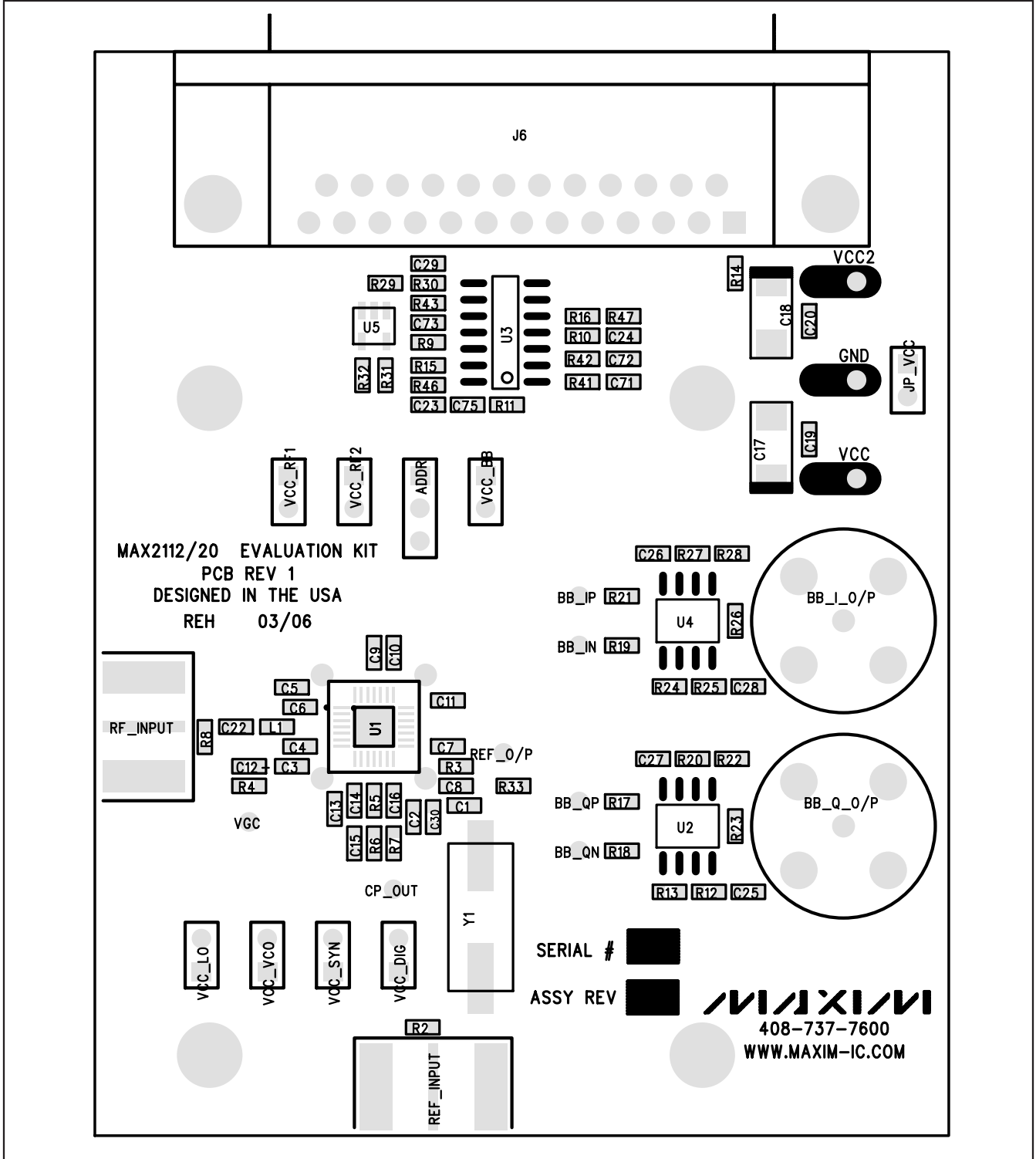


Figure 2. MAX2112 EV Kit PCB Layout—Component Placement Guide

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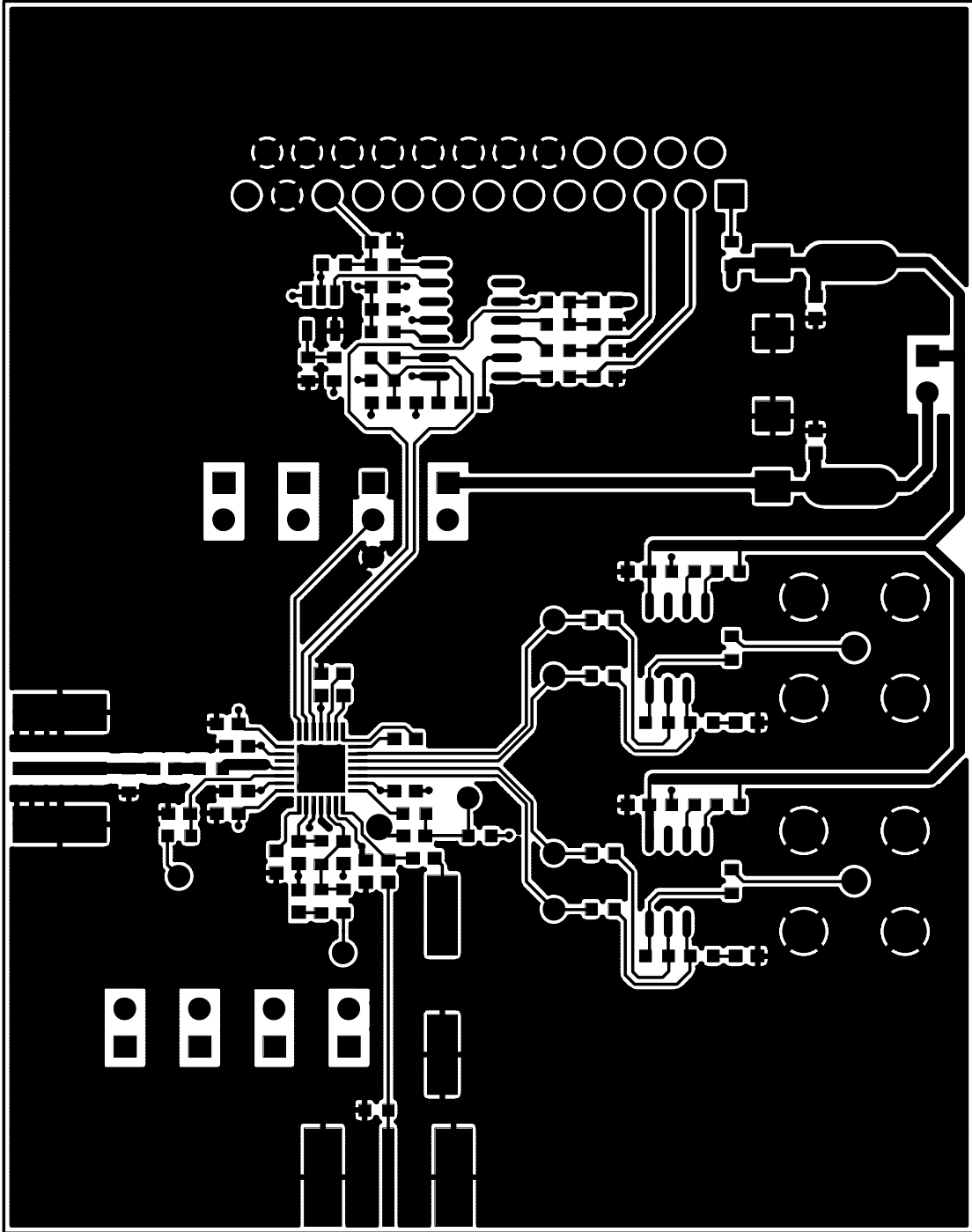


Figure 3. MAX2112 EV Kit PCB Layout—Top

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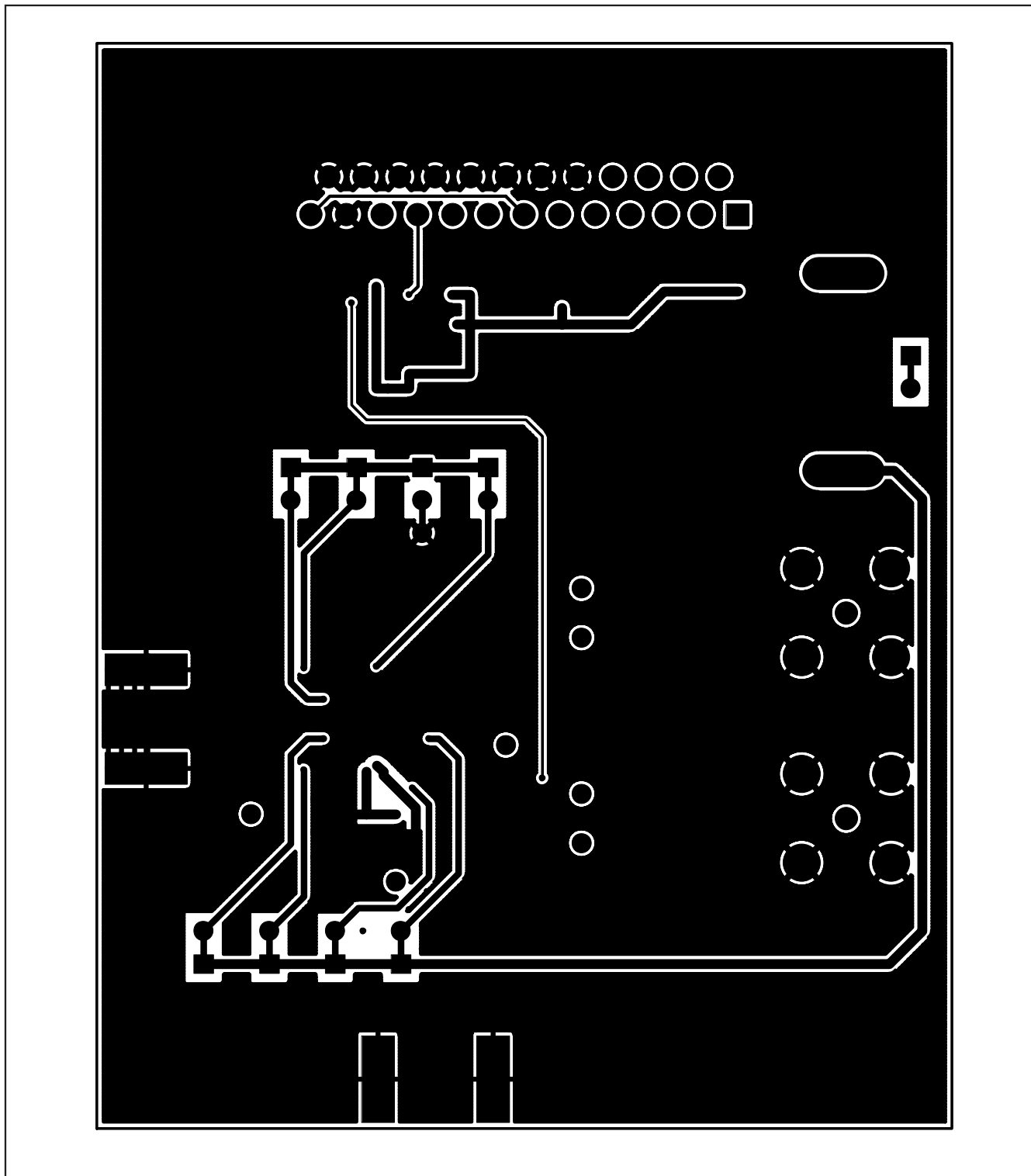


Figure 4. MAX2112 EV Kit PCB Layout—Bottom



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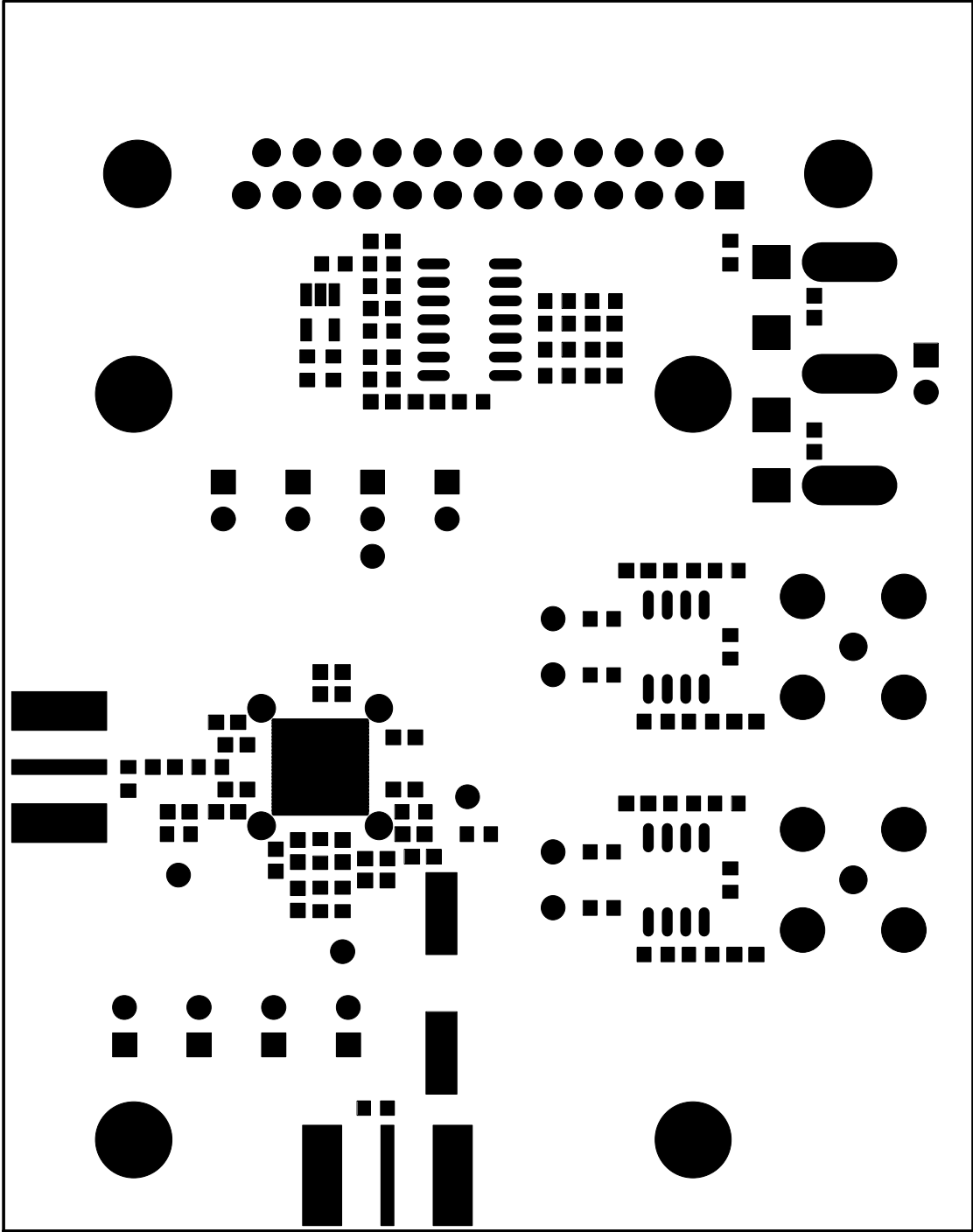


Figure 5. MAX2112 EV Kit PCB Layout—Top Soldermask

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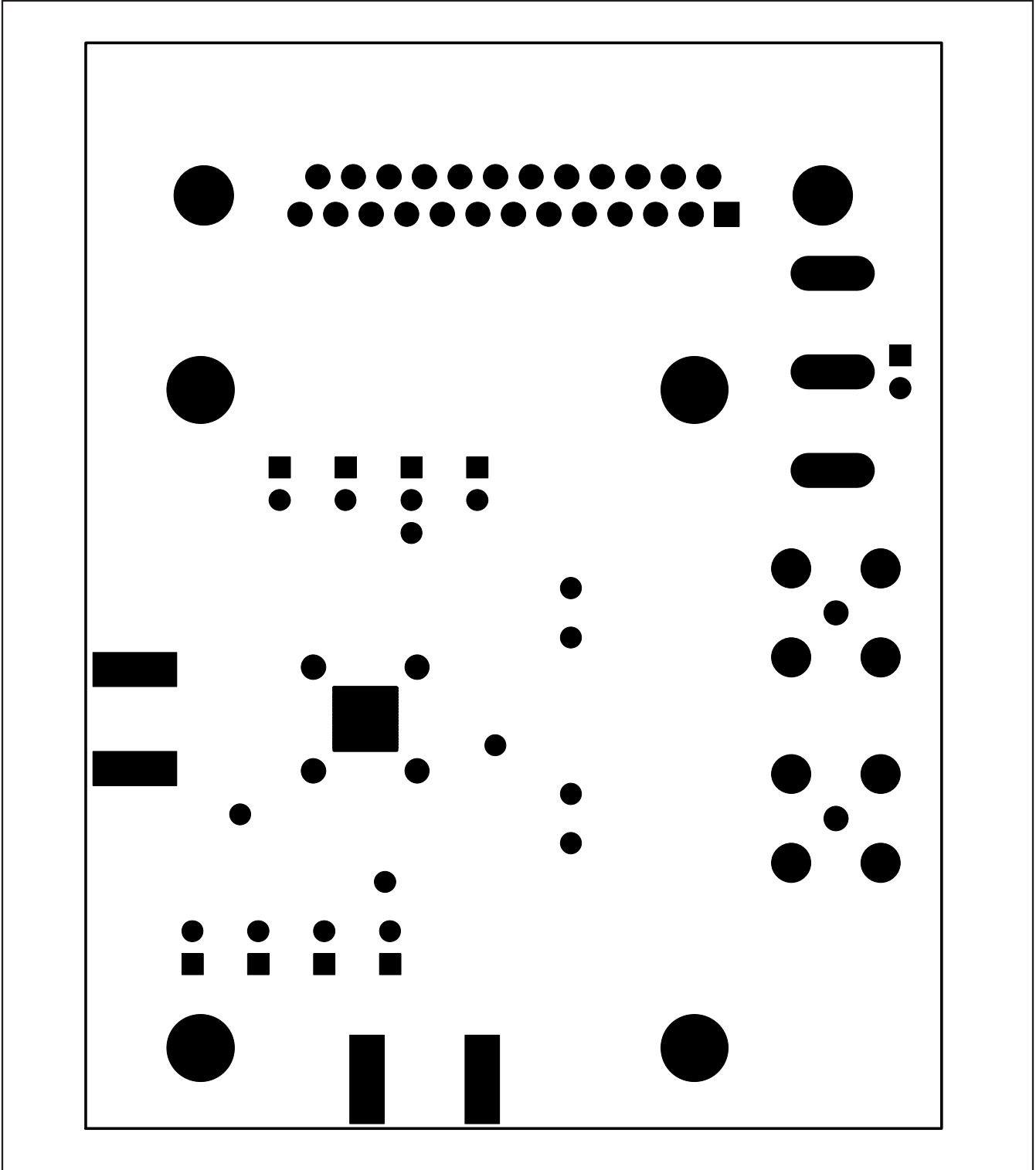


Figure 6. MAX2112 EV Kit PCB Layout—Bottom Soldermask

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## Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	11/07	Initial release	—
1	5/10	Updated L1 in the <i>Component List</i> and Figure 1	2, 5

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